

REMARKS

This reply is filed coincident with a Request for Continued Examination. Claims 1-11 and 13-15 are pending in the present application. Claims 6, 10, and 11 are canceled without prejudice and Applicants reserve the right to re-enter these claims in one or more continuation applications. Claims 1, 3-4, 7-9, and 13-15 have been amended. Claims 16-18 are newly added. No new matter has been added by these amendments or additions.

Claim 1 is amended to clarify that the term “VOC” refers to all volatile organic compounds in the gas stream and that the method is focused on the abatement of the water-insoluble volatile organic compounds contained within the gas stream. The amendment also removes the word “partially” and references to “partial oxidation” and “controlling the rate of flow of water droplets” for reasons described below. Applicants submit that the entire discussion about soluble vs. insoluble VOCs in the published specification, especially paragraph [0068] (having converted the insoluble to something more soluble, “the more soluble substance is removed by the water stream of the scrubber”), provides support for this amendment.

Claims 1, 3-4, and 7-8 are amended simply to add the term “in the range” for clarity.

Claim 7 is also amended to incorporate °F equivalents with the °C elements.

Claim 8 is amended to re-state one set of limits of the claimed method, support for which can be found in Table 1 of both the present and provisional applications.

Claim 13 is amended to remove reference to oriented strandboard.

Claim 16 is added to describe the method of claim 1 in terms of the load of insoluble VOC. Support for this amendment is found in the published specification, paragraph [0068] and the provisional application page 9, lines 5-6 from the bottom).

Claims 17 and 18 are added to capture the subject matter where the insoluble VOCs are removed from the exhaust streams previously associated with claims 6 and 10, respectively. Accordingly, claims 7-9, and 13-15 are amended to adjust the corresponding dependencies.

Applicants wish to extend their thanks to Examiner Nguyen for the courtesy extended to their representative, Thomas Dekleva, during the telephonic interviews conducted on December 8, 2010 and January 11, 2011. During those interviews, no agreements were reached with

respect to substantive content, but the dialog was useful in helping understand more clearly the concerns and positions of the Examiner and the Applicants.

Rejections of Claims Pursuant to 35 U.S.C. § 112, first paragraph.

Claims 1-11 and 13-15 stand currently rejected under 35 U.S.C. § 112, first paragraph as allegedly failing to comply with the written description requirement. In particular, the Examiner is requiring a listing of the page and line number of the instant specification for the following limitations: “partially oxidizing insoluble organic compounds,” “partial-oxidation products” as now appearing in instant claim 1; “about 60 to about 6000 ppm VOC” of insoluble volatile organic compounds as now appearing in claim 4; and “controlling the rate of flow of water droplets . . . of exhaust gas flow.” Applicants traverse these rejections for reasons provided below.

The Examiner takes exception to the terms in claim 1, which refer to a process comprising “partially oxidizing insoluble organic compounds,” “partial-oxidation products.” Both the present published application (paragraph [0068]) and the provisional application (page 9, 3rd full paragraph) describe the reaction of insoluble VOCs with OH radicals, which results in the transformation of the molecule “into a new molecule or radical which is polar and more soluble.” The reaction of organic molecules with hydroxyl radicals is well known by those skilled in the art of organic chemistry to constitute an oxidation process. Indeed, the Examiner’s own Masuda reference (see below) characterizes OH radicals as “oxidizing” (page 418, line 7). The fact that the Applicants have not used the specific terms “partially oxidizing” or “partial-oxidation products” is of no consequence, as long as the Applicants’ language *reasonably* conveys to the skilled artisan that they were in possession of the invention at the time the invention was filed. Rochester, 358 F.3d at 923; Regents of the Univ. of Cal. v. Eli Lilly & Co., 119 F.3d 1559, 1566-67 (Fed. Cir. 1997) (such disclosure need not recite the claimed invention in *haec verba* – literally “in these words”). Applicants submit that, given the general understanding normally applied to the reaction of hydroxy radicals with organic compounds, that they met their burden of reasonable conveyance at the time of filing of even the provisional application. During the telephonic interview, the Examiner clarified that the particular concern

was about the use of the terms “partial” and “partially-oxidized.” While Applicants do not necessarily agree with this concern, in an effort to advance prosecution, these terms are removed in the present amendment. On doing so, Applicants submit that the present language delimits the claim from the need for “partial” oxidation. That is, “oxidizing insoluble organic compounds” encompasses complete or partial oxidation of the compounds and use of the term “one or more products that are soluble in the water spray droplets” no longer requires that these products even be oxidized, as intended in the provisional application.

The Examiner also appears to be taking exception to the limits of “about 60 to about 6000 ppm VOC,” though acknowledging there is clear support for these limits. In attempting to resolve any apparent conflict, Applicants note that the acronym “VOC” refers to “volatile organic compound(s)” and not *“insoluble volatile organic compound(s).”* This acronym is well known those skilled in the present art, and is not used in this application in a way inconsistent with this interpretation. The present claims 1 and 4 refer to a process for removing insoluble VOCs from a waste stream containing both soluble and insoluble VOC, where the insoluble VOCs can be removed therefrom when the total loadings of the combined soluble and insoluble VOCs are in the range of about 60 to about 6000 ppm. Again, support for this range and language can be found in the published application (paragraphs [0022] and [0036]). This position is clarified by the present amendment to claim 1.

Finally, the Examiner takes exception to the term “controlling the rate of flow of the water droplets or the water film so that the ratio of the flow of spray of water droplets or water film to the exhaust gas flow is about 0.2 to about 2 milliliters/minute at one standard liter per minute of exhaust gas flow” as found in claim 1. During the telephonic interview of December 8, 2010, the Examiner emphasized that the word “controlling” was allegedly problematic. Again, Applicants submit that the Examiner is looking for verbatim support for this language where none is required. The concept that a specific “ratio of the water spray rate to the exhaust gas flow [of] about 0.2 to about 2 milliliters/minute at one standard liter per minute of exhaust gas flow” is clearly defined in the published application (e.g., paragraph [0022]) and provided in the provisional application (describing critical minimum water flow rates for methanol of about 0.2 mL/min – page 8, line 15 – up to 2 mL/min water at 1 SLM for acetone – page 8, lines 25-26

– and water flow rates of 1.5 mL/min at 1 SLM for the mixture of Table 3 – page 10, lines 1-2). The fact that a skilled artisan, in seeking to maintain these limits, would actual *control* to these limits would appear to be implied if not commonly understood by that same skilled artisan. As such, Applicants submit that they met their burden for written description with regard to this phrase. However, in an effort to advance prosecution, Applicants have removed the reference to “controlling the flow rate,” with the understanding that this feature may later be re-introduced either in this application or in a future continuation application.

Accordingly, Applicants request reconsideration and withdrawal of the present written description rejection.

Rejections of Claims Pursuant to 35 U.S.C. § 103(a) to the Masuda, Schiffner, and Makin References.

Claims 6-15 stand currently rejected under 35 U.S.C. § 103(a) as allegedly obvious over Masuda *et al.* (“Novel Plasma Chemical Technologies. . .,” Journal of Electrostatics, Vol. 34, No. 4, May 1995, pp. 415-438; “the Masuda reference”), and optionally in view of U.S. Patent No. 5,861,123 (“the Schiffner reference”) and U.S. Patent No. 4,181,675 (“the Makin reference”). In particular, the Examiner points to section 4(d) on page 419 of the Masuda reference as the basis for the rejection. Applicants submit that this rejection is moot in view of the current amendments.

Independent claims 6 and 10 are canceled, being replaced by new claims 17 and 18, respectively, each of which depends from claim 1. Claim 1 is properly not currently subject to a rejection based on these references. The Masuda reference, with or without the Makin and/or Schiffner references, does not teach or suggest all of the elements of claim 1, particularly the water flow rates or energy inputs, nor does it provide direction as to how best to optimize these parameters. Accordingly, Applicants request reconsideration and withdrawal of the present rejection.

Rejections of Claims Pursuant to 35 U.S.C. § 103(a) to the Sobacchi Reference

Claims 1-15 stand currently rejected under 35 U.S.C. § 103(a) as allegedly obvious over Sobacchi *et al.* (“Experimental assessment of non-thermal plasma techniques for removal of

paper industry VOC emissions," 15th International Symposium on Plasma Chemistry, Orleans, July 9-13, 2001, taken from <http://plasma.mem.drexel.edu/publications/>), optionally further in view of the Makin reference. Applicants traverse these rejections for the reasons given below.

Applicants first note that the amendments to claim 1 provide that claim 1 is now fully supported in the provisional application, such that this Sobacchi reference is no longer available as 102(b) prior art. In particular, the terms "partially oxidizing," "controlling the rate of flow," and "about" (as in about 0.2 to about 2 mL/min) have been removed. The support in the provisional application for the first two these are provided above. With respect to the term "about 0.2," Applicants note that this does find support in the provisional application, page 8, line 15, where the critical water flow rate for methanol is described in terms of $Q_{w-crit} \sim 0.2$ mL/min. Applicants submit that the symbol "~-" is universally understood to represent "about" or "approximately."

However, even if the Sobacchi could be considered available as 102(b) prior art, Applicants submit that it still neither anticipates nor renders obvious the instant claims, with or without the Makin reference.

Claim 1 describes a method for removing insoluble VOCs comprising, among other features, providing a plasma reaction in the presence of a *liquid* water spray or film ("so that the ratio of the flow of *liquid* spray of liquid water droplets or water film to the exhaust gas flow is about 0.2 to about 2 milliliters/minute at one standard liter per minute of exhaust gas flow"). The Sobacchi reference does not teach or suggest this limitation for soluble or insoluble VOCs, nor does it describe any enabled experiments whose conditions fall within these limits. First, the Sobacchi reference does not disclosed a flow ratio as claimed herein. Second, the conditions of the Sobacchi reference precludes "a flow of spray of *liquid* water droplets or water film" in the presence of the plasma discharge. These conclusions do not depend on whether Applicants rely on the provisional or as-filed application.

The Examiner describes Sobacchi reference as providing an example wherein water was provided at a flow rate of 0.25 mL/min with a gas flow rate of 2 SLM to a 220°C corona discharge reactor (Sobacchi, page 3). The Examiner acknowledges that the calculated value of the water to exhaust gas flow (0.125 mL/min at one SLM) is outside the claimed range (Office

Action dated 10/12/2010, pages 6-7), but argues that the value itself would have suggested a slightly higher value based upon a reasonable expectation of success.

Even if Applicants were to accept this argument, which they do not, the argument overlooks the fact that, at 220°C, the injected water would not – and could not -- exist as a *liquid* water spray or film. In fact, the very experimental design described by the Sobacchi reference precludes a plasma reaction in the presence of such a water spray or film. As described in the Experimental Section (Sobacchi, page 2, 2nd full paragraph), while liquid flows of water and VOCs are metered into the Sobacchi system, they are fully evaporated and mixed “in a stainless steel pre-mixing chamber, heated to 160°C and filled with glass beads. All stainless steel connecting lines have been heated by means of heating tapes *to prevent condensation of* reactants and products.”

In making a similar rejection in the previous office action, the Examiner then argued that “it would have been obvious to one skilled in the art to optimize the amount of water to provide absorption, not just merely simulate the humidity of the exhaust gases in pulp mills” (Office Action dated 1/7/2010, page 11), based on a statement in page 2 of the Sobacchi reference which reads that the “corona and gliding plasma arc reactors were designed to allow water injection, in order to study a synergistic effect of plasma chemistry and absorption into water on the VOC removal.” However, the authors present no data to confirm that any experiments were actually carried out to take advantage of these capabilities or that any advantage in removing insoluble VOCs might be realized by the presence and use of liquid water. It is not clear whether the authors meant real or imagined synergistic effect. Again, the experimental protocols and results described in the Sobacchi reference follow from pure gas phase reactions, with no separate liquid water phase. Therefore, the concept of providing water as liquid water so as to provide absorption appears to be completely contrary to the teaching of this reference. Applicants submit that the Sobacchi reference is deficient in teaching all of the limitations of claim 1, and actually teaches away from using liquid water spray or films in concert with plasma conditions to remove any type of VOCs.

The Examiner seeks to remedy the deficiencies of the Sobacchi reference with the Makin reference, but this combination is now flawed on two bases. The Makin reference is said to

teach that methanol vapor can be removed by scrubbing with water (Office Action dated 10/12/2010, page 4). However, claim 1 captures the removal of *insoluble* VOCs, whereas methanol is characterized as a soluble VOC. Also, the incorporation of a water absorbent phase is contrary to the principle of operation of the gas phase-only reactions in the Sobacchi reference. Because the proposed combination of references would destroy the functioning of the Sobacchi reference, or make it unsatisfactory for its intended purpose, Applicants submit that the skilled artisan would not be motivated to combine these references. MPEP §2143.01.

Accordingly, Applicants submit that the Examiner has not met the Office's burden of providing a *prima facie* case for obviousness, which requires (1) a clearly articulated reason or rationale, either in the prior art itself or in the knowledge generally available to one of ordinary skill in the art, why the claimed invention is obvious in light of a reference or combined reference teachings; (2) a reasonable expectation of success; and (3) that the prior art combination must address all of the elements of the claim at issue. MPEP § 2143.03. Since claim 1 is not obvious or anticipated by the Sobacchi reference (even when optionally considered with the Makin reference), then those claims depending from it, and subject to its limitations, are likewise not obvious or anticipated. *Ortho-McNeil Pharm, Inc. v. Mylan Labs, Inc.* 520 F.3d 1358, 1365 (Fed. Cir. 2008) (a dependent claim depending from a non-obvious independent claim is itself non-obvious). It is not necessary for Applicants to consider whether the various elements highlighted in the present office action (page 5) do or do not find support in the provisional application. This conclusion about non-obviousness is correct even if some of those dependent claims have content which may not be found in the parent provisional application. Applicants request reconsideration and withdrawal of these rejections.

Conclusion

Applicants believe that the foregoing constitutes a complete and full response to the Office Action of record. Applicants respectfully submit that all pending claims are in condition for allowance and entry of the present amendments and notification to that effect is earnestly requested. Should the Examiner have any further questions, he is invited to contact the undersigned attorney at the number below.

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